Conel

A B&B ELECTRONICS Company

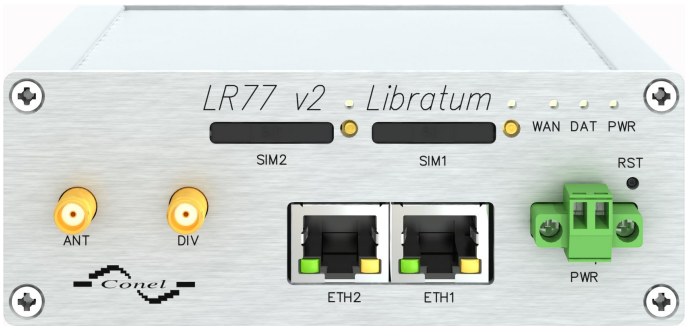
LUCOM

The connecting & monitoring company

LTE router

LR77 v2 Libratum

USER'S MANUAL



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Used symbols

Danger – important notice, which may have an influence on the user's safety or the function of the device.

Attention – notice on possible problems, which can arise in specific cases.

Information, notice – information, which contains useful advice or special interest.

GPL license

Source codes under GPL license are available free of charge by sending an email to:

info@conel.cz.

Conel s.r.o., Sokolska 71, 562 04 Usti nad Orlici, Czech Republic
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1. Safety instruction

Please, observe the following instructions:

- The router must be used in compliance with all applicable international and national laws and in compliance with any special restrictions regulating the utilization of the router in prescribed applications and environments.
- To prevent possible injury to health and damage to appliances and to ensure that all the relevant provisions have been complied with, use only the original accessories. Unauthorised modifications or utilization of accessories that have not been approved may result in damage to the router and in a breach of applicable regulations. Unauthorized modifications or utilization of accessories that have not been approved may result in the termination of the validity of the guarantee.
- The router can not be opened.
- Before handling of the SIM card turn off the router and disconnect it from power supply.
- **Caution!** The SIM card could be swallowed by small children.
- It must not be exceeded by the maximum voltage 30 V DC power connector on the router.
- Do not expose the router to extreme ambient conditions. Protect the router against dust, moisture and high temperature.
- The router should not be used at petrol stations of flammable and explosive materials. We remind the users of the duty to observe the restrictions concerning the utilization of radio devices at petrol stations, in chemical plants, or in the course of blasting works in which explosives are used.
- Switch off the router when travelling by plane. Utilization of the router in a plane may endanger the operation of the plane or interfere with the mobile telephone network, and may be unlawful. Failure to observe these instructions may result in the suspension or cancellation of telephone services for the respective client, or, it may result in legal sanctions; it may also result in both eventualities.
- When using the router in the close proximity of personal medical devices, such as cardiac pacemakers or hearing aids, you must proceed with heightened caution.
- If it is in the proximity of TV sets, radio receivers and personal computers, the telephone may cause interference.
- It is recommended that you should create an appropriate copy or backup of all the important settings that are stored in the memory of the device.

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2. Product disposal instructions

The WEEE (Waste Electrical and Electronic Equipment: 2002/96/EC) directive has been introduced to ensure that electrical/electronic products are recycled using the best available recovery techniques to minimize the impact on the environment. This product contains high quality materials and components which can be recycled. At the end of it's life this product MUST NOT be mixed with other commercial waste for disposal. Check the terms and conditions of your supplier for disposal information.

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3. Router description

LTE router LR77 v2 Libratum is used to wireless connect various equipments and devices via Ethernet interface 10/100 to the internet or intranet. Due to the high data transfer speed of up to 14.4 Mbit/s (download) and up to 5.76 Mbit/s (upload) is this router an ideal wireless solution for traffic and security camera systems, individual computers, LAN networks, automatic teller machines (ATM) and other self-service terminals, etc.

As a standard, LR77 v2 Libratum wireless router is equipped with two Ethernet 10/100 and two SIM card holders. This wireless router is supplied either in a plastic or metal casing, based on the requirements of the customer.

Configuration is done via web interface protected by password. LR77 v2 Libratum supports creation of VPN tunnels using technologies IPsec, OpenVPN and L2TP to ensure safe communication. Web interface provides detail statistics about the 3G router activities, signal strength, detailed log, etc. Cellular router supports functions: DHCP, NAT, NAT-T, DynDNS, NTP, VRRP, control by SMS and many other function.

Other diagnostic functions ensuring continuous communication include automatic inspection of PPP connection offering an automatic restart feature – in case of connection losses, or hardware watchdog which monitors the status of the router. With the help of a special window (start up script window) you may insert Linux scripts for various actions. For some applications the key option to create several different configurations for one LTE wireless router, the so-called profiles (maximum of 4), and the option to switch between them (for example via SMS, binary input status, etc.) is essential. Cellular wireless routers LR77 v2 Libratum may automatically upgrade configuration and firmware from server. This allows mass reconfiguration of many routers in one time.

For easy use additional software may be used – communication VPN server Digicluster and software for router monitoring R-SeeNet.

Examples of possible applications

- mobile office
- fleet management
- security system
- telematic
- telemetric
- remote monitoring
- vending and dispatcher machines

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4. Contents of package

Basic delivered set of router includes:

- router,
- power supply,
- crossover UTP cable,
- two external antennas,
- clip for the DIN rail,
- paper start guide.

Figure 1: Contents of package

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5. Router design

5.1 Router versions

LR77 v2 Libratum router is supplied in the following versions:

	Box	SIM1	SIM2	ETH1	ETH2
LR77 v2 Libratum	Plastic	✓	✓	✓	✓
LR77 v2 Libratum SL	Metal	✓	✓	✓	✓
LR77 v2 Libratum WIFI	Plastic	✓	✓	✓	✓
LR77 v2 Libratum WIFI SL	Metal	✓	✓	✓	✓

Table 1: Router versions

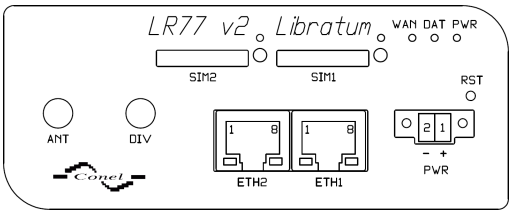

Figure 2: LR77 v2 Libratum

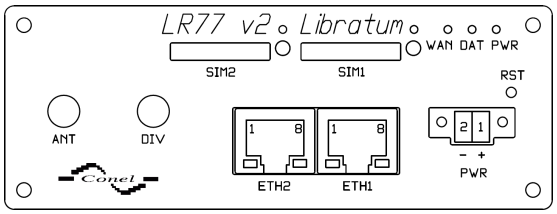

Figure 4: LR77 v2 Libratum SL

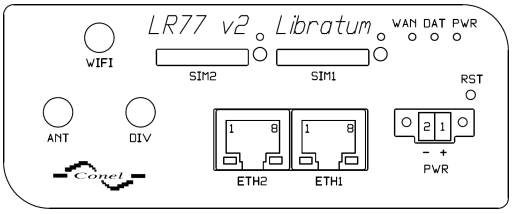

Figure 3: LR77 v2 Libratum WIFI

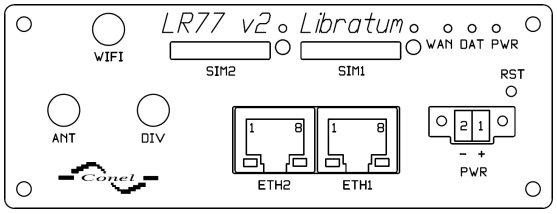

Figure 5: LR77 v2 Libratum WIFI SL

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5.2 Delivery identification

Trade name	Type name	Other
LR77 v2 Libratum	LR-77-v2L	Version in the plastic box
LR77 v2 Libratum SL	LR-77-v2L	Version in the metal box
LR77 v2 Libratum WIFI	LR-77-v2L	Version with WIFI module in the plastic box
LR77 v2 Libratum WIFI SL	LR-77-v2L	Version with WIFI module in the metal box

Table 2: Delivery identification

Figure 6: Label example

5.3 Ordering codes

For this products are the following ordering codes:

- **LR77 v2 Libratum set**
  includes 2x Ethernet and 2x SIM, supplied in plastic box
- **LR77 v2 Libratum SL set**
  includes 2x Ethernet and 2x SIM, supplied in metal box
- **LR77 v2 Libratum WIFI set**
  includes 2x Ethernet, 2x SIM and 1x WIFI, supplied in plastic box
- **LR77 v2 Libratum WIFI SL set**
  includes 2x Ethernet, 2x SIM and 1x WIFI, supplied in metal box

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5.4 Basic dimensions of plastic box

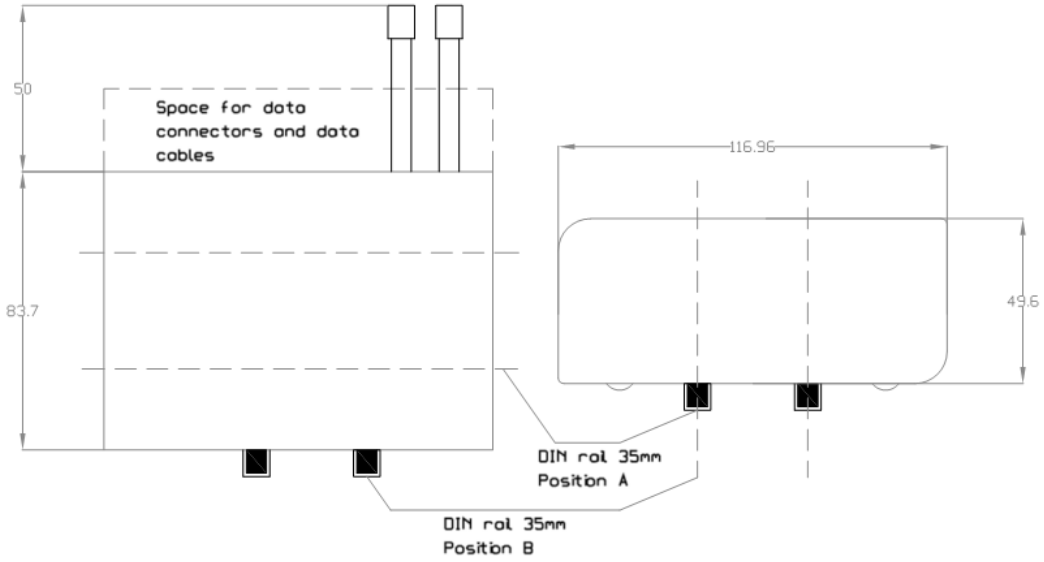

Figure 7: Basic dimensions of plastic box

5.5 Basic dimensions of metal box

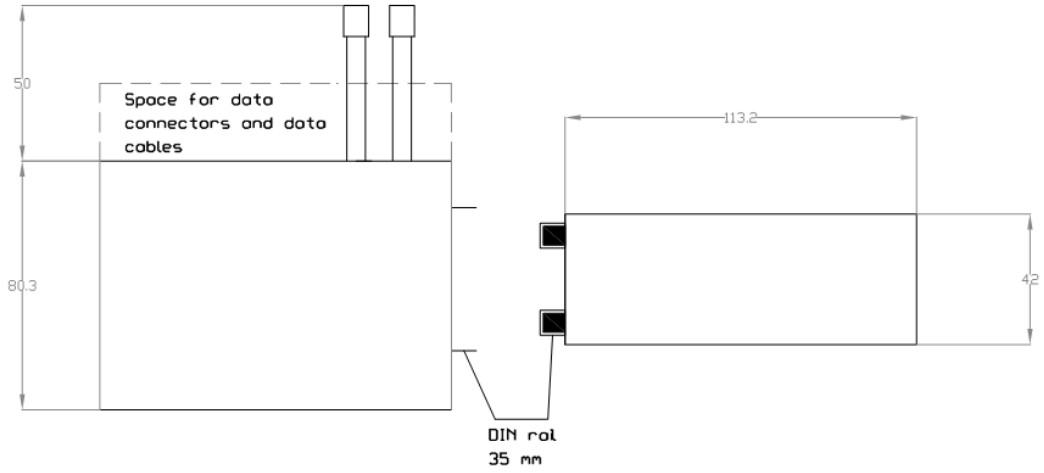

Figure 8: Basic dimensions of metal box

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5.6 Mechanical dimensions and mounting recommendations

Mounting recommendations:

- possibility to be put on a work surface,
- DIN rail with clips CKD2 (ELPAC clip SL for metal version) are included.

For the most of applications with a built-in router in a switch board it is possible to recognize two kinds of environments:

- no public and industry environment of low voltage with high interference,
- public environment of low voltage without high interference.

For both of these environments it is possible to mount router to a switch board, the following there is no need to have examination immunity or issues in connection with EMC according to EN 60439-1 ed.2:00 + A1:04.

For compliance of EN 60439-1 ed.2:00 + A1:04 specification it is necessary to observe next assembly of the router to the switch – board:

- for whip antennas we recommend to observe a distance of 6 cm from cables and metal surfaces on every side according to the next picture due to the elimination of interference, while using an external antenna except for the switch-board it is necessary to fit a lightening conductor,
- before mounting a router on sheet-steel we recommend using an external antenna,

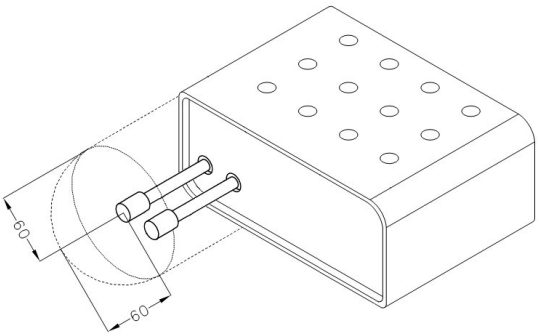

Figure 9: Space around antennas

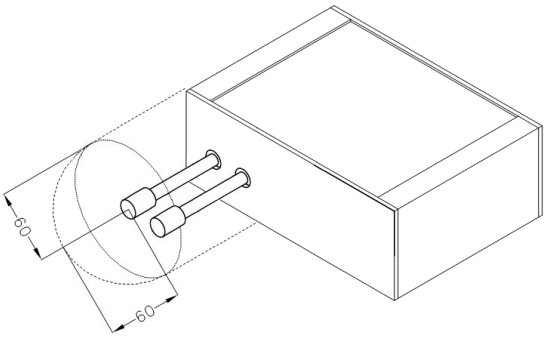

Figure 10: Space around antennas for SL

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- For every cables we recommend to bind the bunch according to the following picture, we recommend for this use:
  - Length of the bunch (combination of power supply and data cables) can be maximum 1.5 m. If the length of data cables exceeds 1.5 m or in the event of, the cable leads towards the switch – board. We recommend installing over – voltage protectors (surge suppressors).
  - With data cables they mustn't carry cables with reticular tension ∼ 230 V/50 Hz.
  - All signals to sensors must be twisted pairs.

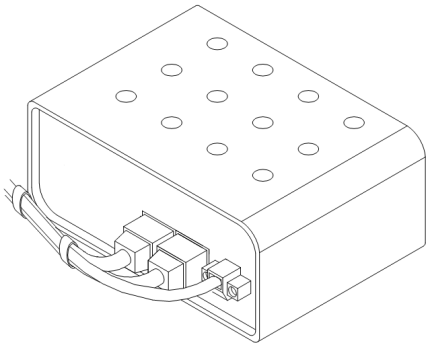

Figure 11: Cable routing

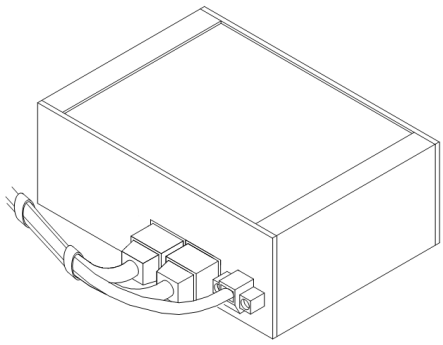

Figure 12: Cable routing for SL version

- Sufficient space must be left before individual connectors for handling of cables,

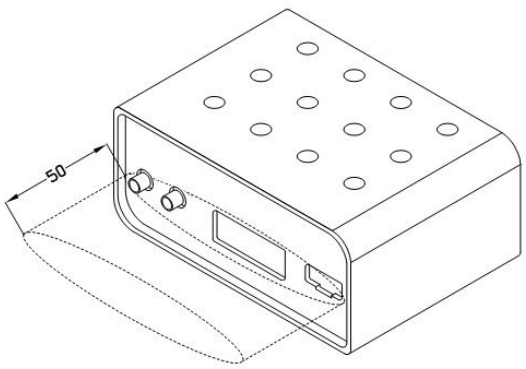

Figure 13: Space in front of connectors

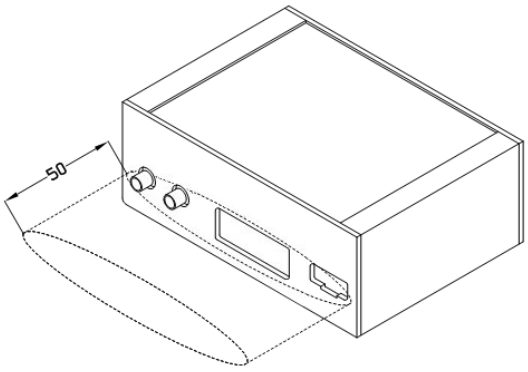

Figure 14: Space in front of connectors – SL

- For correct function of the router we recommend to use in the switch-board earth-bonding distribution frame for grounding of power supply of router, data cables and antenna.

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5.7 Removing from the DIN rail

Default position of CPD2 holder (or CKD2 holder for SL version), which is used for mounting the router on a DIN rail, is shown in the following figure:

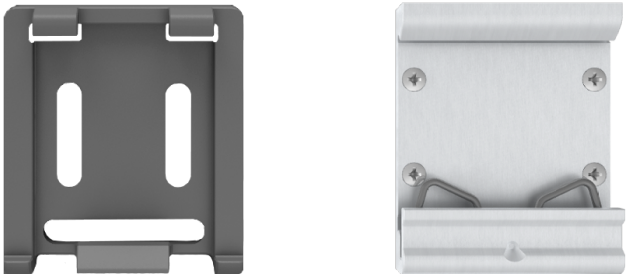

Figure 15: Default position of DIN holder

For removing from the DIN rail it is necessary to lightly push upward the router so that the top part of the CPD2 holder (or CKD2 for SL version) hitched to the DIN rail get out of this rail and then fold out the top part of the router away from the DIN rail.

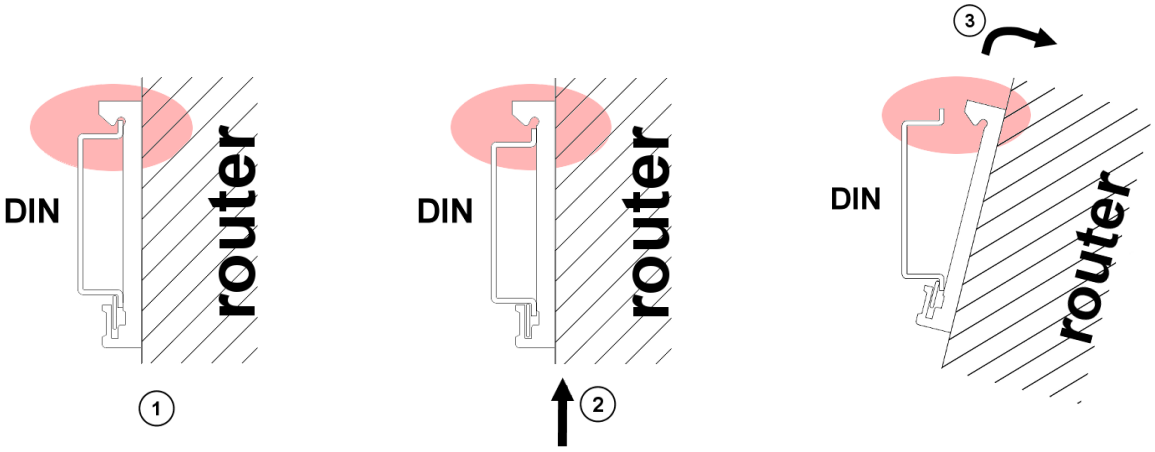

Figure 16: Removing from the DIN rail

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5.8 Description of the front panel

On the front panel is located:

Caption	Connector	Description
PWR	2-pin	Connector for the power supply adapter.
ETH1	RJ45	Connector for connection into the local computer network.
ETH2	RJ45	Connector for connection into the local computer network.
ANT	SMA	Connector for main antenna.
DIV	SMA	Connector for diversity antenna.
WIFI	R-SMA	Connector for WIFI antenna (only for version with WIFI module).
SIM1	—	Holder for the first SIM card.
SIM2	—	Holder for the second SIM card (only FULL version).

Table 3: Front panel description

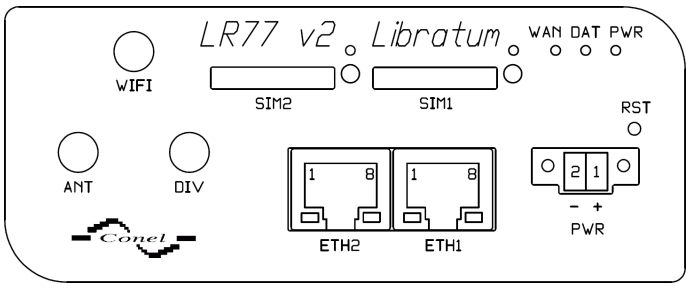

Figure 17: Front panel LR77 v2 Libratum

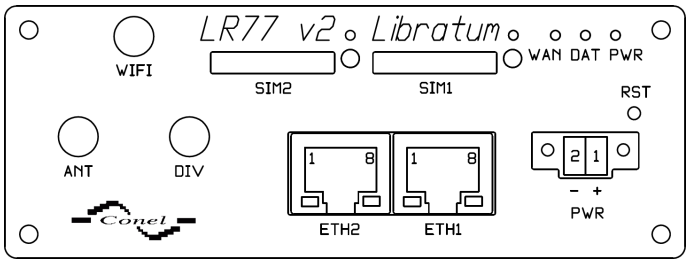

Figure 18: Front panel LR77 v2 Libratum SL

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5.8.1 Status indication

About router status inform three LED indicators on the front panel and on every ETH port are two LED indicators, which inform about port status.

Caption	Color	State	Description
PWR	Green	Blinking On Fast blinking	Router is ready Starting of the router Updating firmware
DAT	Red	Blinking	Communication in progress on radio channel
WAN	Yellow	1x flash per second 2x flash per second 3x flash per second	Signal strength is from –50 dBm to –69 dBm Signal strength is from –70 dBm to –89 dBm or difference between neighbours cells is exactly 3 dBm Signal strength is from –90 dBm to –113 dBm or difference between neighbours cells is smaller than 3 dBm
ETH	Green	On Off	Selected 100 Mbit/s Selected 10 Mbit/s
ETH	Yellow	On Blinking Off	The network cable is connected Data transmission The network cable is not connected
SIM1	Yellow	On	SIM card 1 is active
SIM2	Yellow	On	SIM card 2 is active

Table 4: Router status indication

State indication of WAN LED is updated every 10 seconds.

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5.8.2 Power connector PWR

Panel socket 2-pin.

Pin number	Signal mark	Description
1	VCC(+)	Positive pole of DC supply voltage (+10 to +30 V DC)
2	GND(-)	Negative pole of DC supply voltage

Table 5: Connection of power connector

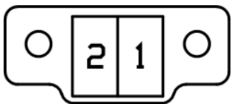

Figure 19: Power connector

Power supply for router is required between +10 V to +30 V DC supply. Protection against reversed polarity without signaling is built into the router.

The power consumption during receiving is 2.3 W. The peak power consumption during data sending is 5.5 W. However, values of consumption can be increased, if some expansion port is eqquipped. For correct operation it is necessary that the power source is able to supply a peak current of 1 A.

Connector on the power cable connects into the power connector on the router head and tightens locking screws (see figure below).

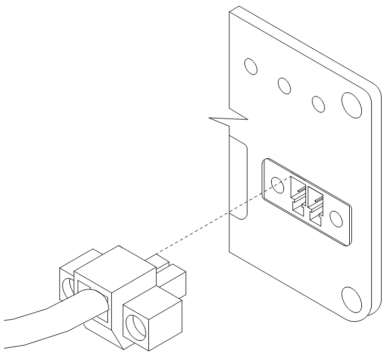

Figure 20: Connection of power supply connector

Circuit example:

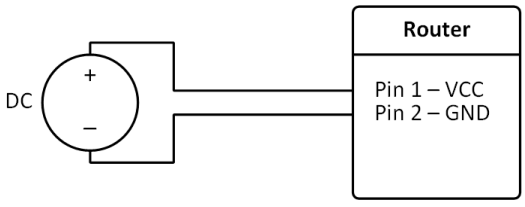

Figure 21: Connection of power supply

The positive pole VCC is marked by a red socket on the power.

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5.8.3 Antenna connector ANT, DIV (and WIFI)

Main and diversity antennas are connected to the router using the SMA connector on the front panel. For LR77 v2 Libratum with WIFI module is also available reverse SMA antenna connector, through which the WIFI antenna can be connected.

The router can not operate without the main antenna connected labeled as ANT.

ANT connector is used to connect the main antenna router. To connect the diversity antenna is used the second antenna connector DIV. In version with WIFI module is also available WIFI connector used for antenna, which is intended to communicate via WIFI.

Example of antenna:

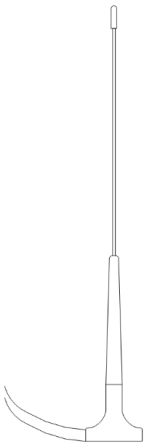

Figure 22: External antenna

For connection the antenna is used SMA connector. The antenna is connected by screwing this antenna to the SMA connector on the front panel of the router (see figure below).

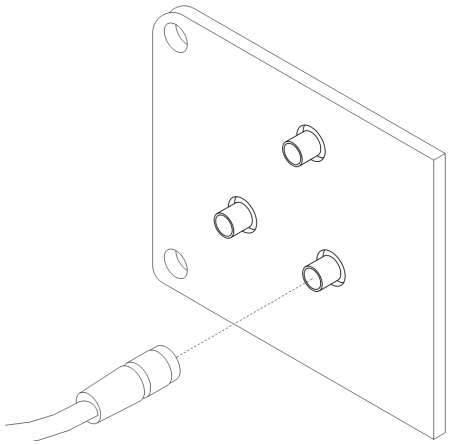

Figure 23: Connecting of the antenna

Diversity antenna improves radio features of the router at low signal strength.

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5.8.4 SIM card reader

Two SIM card readers for 3 V and 1.8 V SIM cards are located on the front panel of the router. To initiate the router into operation it is necessary to insert an activated SIM card with unblocked PIN in the reader. The SIM cards can have different APN (Access Point Name).

Changing the SIM card:

Before handling of the SIM card turn off the router and disconnect it from power supply.

Press the small yellow button to eject the reader holder. Insert the SIM card into the reader holder and slide it in the reader (see figure below).

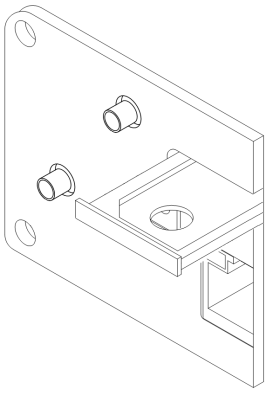

Figure 24: Ejected SIM holder

For correct function of mobile network module **it is necessary to have both SIM card holders inserted in the readers when router is running**, even if they are empty. Ejected holder of any SIM card can cause inability to connect the mobile network.

5.8.5 Ethernet port

Panel socket RJ45.

Pin	Signal mark	Description	Data flow direction
1	TXD+	Transmit Data – positive pole	Input/Output
2	TXD-	Transmit Data – negative pole	Input/Output
3	RXD+	Receive Data – positive pole	Input/Output
4	—	—	
5	—	—	
6	RXD-	Receive Data – negative pole	Input/Output
7	—	—	
8	—	—	

Table 6: Connection of Ethernet connector

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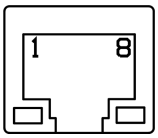

Figure 25: Ethernet connector

ATTENTION! Port ETH is not POE (Power Over Ethernet) compatible!

Ethernet cable plug into the RJ45 connector labeled as ETH (see figure below).

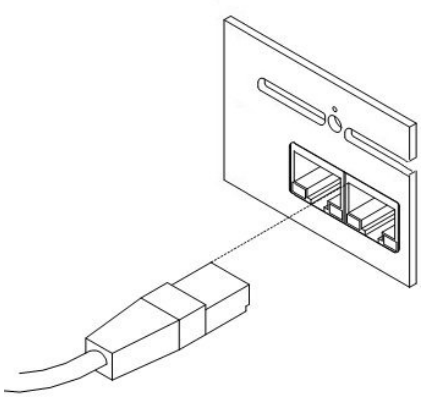

Figure 26: Connection of ethernet cable

Example of the ETH router connection:

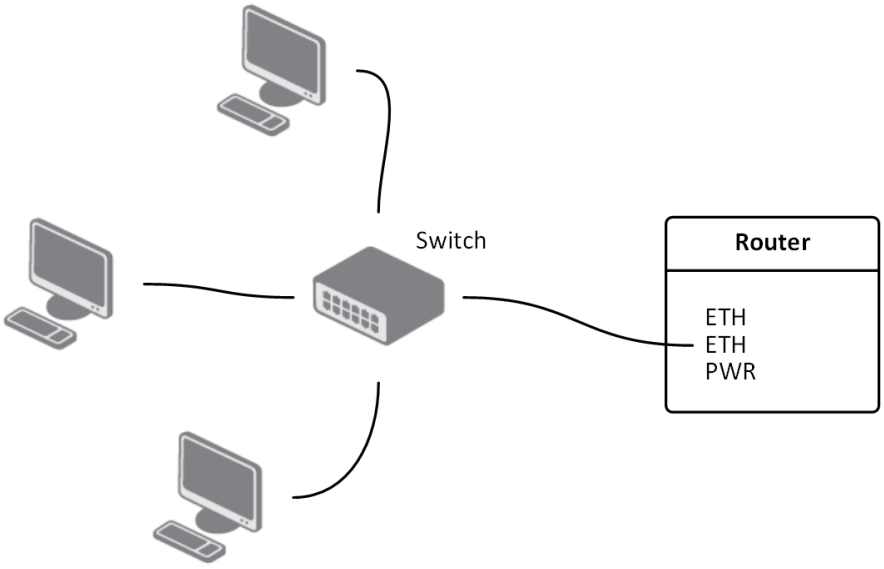

Figure 27: Example of router connection

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5.8.6 Reset

It is important to distinguish between reset and reboot the router.

Action	Router behavior	Invoking events
Reboot	Turn off and then turn on router	Disconnect and connect the power, Press the *Reboot* button in the web configuration
Reset	Restore default configuration and reboot the router	Press RST button

Table 7: Description of reset and restart router

After green LED starts to blink it is possible to restore initial settings of the router by pressing button RST on front panel. After press button RST it is restoration of default configuration and reboot (green LED will be on).

For pressing the RST button could be used a narrow screwdriver.

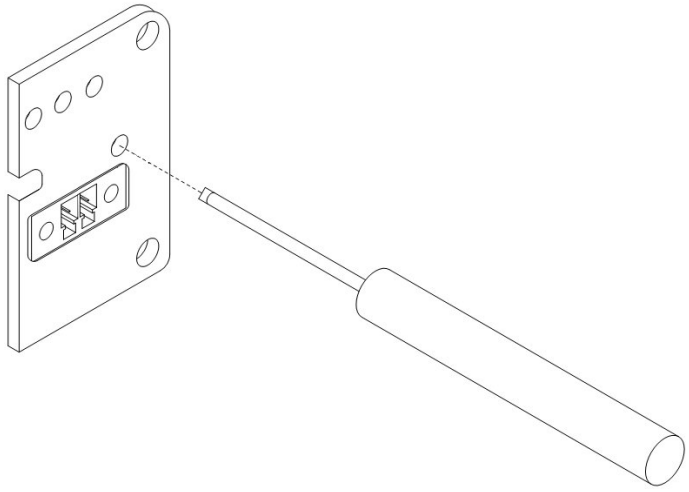

Figure 28: Router reset

We recommend to backup your router configuration (see Configuration manual), because after reset router set configuration to the initial state.

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6. First use

6.1 Connecting the router before first use

Before you give up the router, it is necessary to connect all components needed for the operation of your applications and the SIM card must be inserted (see figure below).

The router can not operate without connected antenna, SIM card and power supply. If the antenna is not connected, router can be demaged.

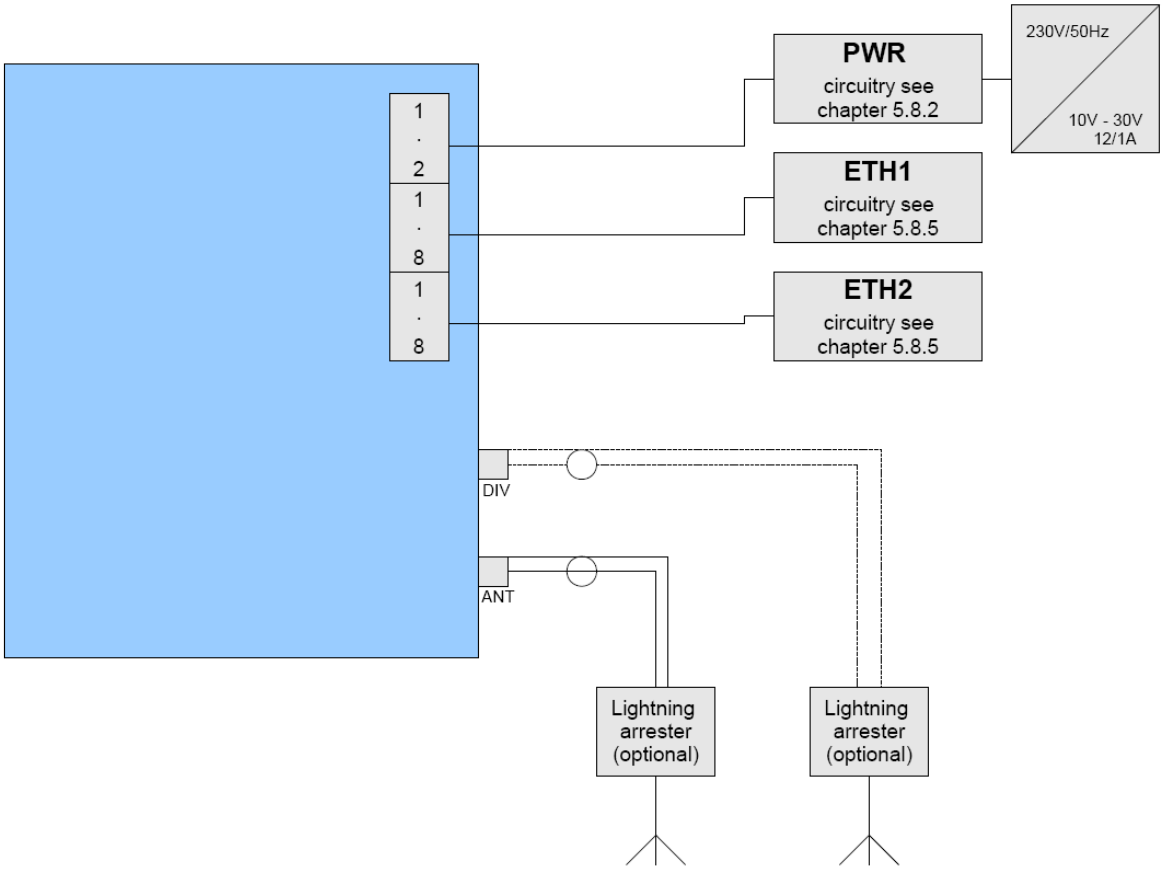

Figure 29: Router connection

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6.2 Start

The router is set up connecting the power supply to the router. In the default setting the router starts to login automatically to the preset APN. Device on the Ethernet port DHCP server will assign addresses. The behavior of the router can be modified by means of the web or Telnet interface, which is described in the configuration manual.

The power consumption during receiving is 2.3 W. The peak power consumption during data sending is 5.5 W. However, values of consumption can be increased, if some expansion port is eqquipped. For correct operation it is necessary that the power source is able to supply a peak current of 1 A.

6.3 Configuration

Attention! If the SIM card is not inserted in the router, then it is impossible to operate. The inserted SIM card must have activated LTE/HSPA+/UMTS/EDGE/GPRS.

6.3.1 Configuration over web browser

Monitoring of the status, configuration and administration of the router can be performed by means of the web interface, which is available after insertion of IP address of the router into the web browser. The default IP address of the router is 192.168.1.1. Configuration may be performed only by the user "root" with initial password "root".

A detailed description of the router settings via the Web interface can be found in the configuration manual.

6.3.2 Configuration over Telnet

Monitoring of status, configuration and administration of the router can be performed by means of the Telnet interface. After IP address entry to the Telnet interface it is possible to configure the router by the help of commands. The default IP address of the router is 192.168.1.1. Configuration may be performed only by the user "root" with initial password "root".

A detailed description of the router settings via the Telnet interface can be found in the configuration manual.

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7. Technical parameters

7.1 Technical parameters of router

LR77 v2 Libratum		
Complies with standards		EN 301 511, v9.0.2, EN 301 908-1 & -2: v3.2.1, ETSI EN 301 489-1 V1.8.1, EN 60950-1:06 ed.2 + A11:09 + A1:10
Temperature range	Function Storage	-40 °C to +70 °C -40 °C to +85 °C
Protection		IP20
Supply voltage		10 to 30 V DC
Consumption	Reception GPRS LTE	2.3 W to 3.5 W (GPRS transmission) to 5.5 W (LTE transmission)
Dimensions	Plastic box Metal box	51 x 87 x 116 mm (DIN 35 mm) 42 x 87 x 113 mm (DIN 35 mm)
Weight		LR77 v2 Libratum – 150 g LR77 v2 Libratum SL – 280 g
Antenna connector		SMA – 50 Ohm
User interface	2x ETH	Ethernet (10/100 Mbit/s)

Table 8: Technical parameters of router

7.2 Technical parameters of module

LTE modul	
LTE parameters	Bit rate 100 Mbps (DL) / 50 Mbps (UL) 3GPP rel. 8 standard Supported bandwidths: 5 Mhz, 10 Mhz, 20 Mhz
HSPA+ parameters	Bit rate 42 Mbps (DL) / 5,76 Mbps (UL) 3GPP rel. 6/7 standard Data compress 3GPP
UMTS parameters	Bit rate 384 kbps (DL) / 384 kbps (UL) 3GPP rel. 4 standard

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LTE modul	
GPRS/EDGE parameters	EDGE bit rate 237 kbps (DL) / 237 kbps* (UL) GPRS bit rate 85.6 kbps (DL) / 85.6 kbps* (UL) Multislot class 12, CS 1 to 4, 3GPP rel. 99/4 standard
Support channels	Quad band LTE: 800/900/1800/2600 MHz Tri band UMTS (WCDMA): 900/1800/2100 MHz Dual Band GSM/GPRS/EDGE: 900/1800 MHz

Table 9: Technical parameters of module

* Depending on the capabilities of the operator

7.3 Technical parameters of processor

32b ARM mikroprocesor	
Memory	512 Mb DDR SDRAM 128 Mb FLASH 1 Mb MRAM
Interface	Serial interface RS232 Ethernet interface 10/100 Mbit/s USB 2.0 interface

Table 10: Technical parameters of processor

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8. Recommended literature

[1] Conel: **Start guide**,
[2] Conel: **Configuration manual**,
[3] Conel: **User's manual – Expansion port ETH**,
[4] Conel: **Application guide – Programmer guide**.

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9. Possible problems

Some network cards are able to be set in situation, when it is not possible to connect the router. It is possible to solve this problem in the following steps:

- hand by selection communication rates 10 MB/s in property network cards,
- connect router over switch,
- start computer only after finalizing the start of the router.

Router can not connect to the mobile network, wireless module is constantly restarting.

- ensure that both SIM card holders are inserted into SIM card slots (readers). It doesn't matter whether there is a SIM card in the holder, but both of them has to be inserted for proper work of the wireless module.

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10. FAQ

- I can't get from internet on equipment, which is connected to router and I have NAT enabled.
  - *The device's gateway has to be configured as the router.*
- Router resets itself, connection on Ethernet fails.
  - *It is necessary to use an antenna, which will be situated far from power supply.*
- I don't get on web server at NAT.
  - *The remote http access of the router has to be disabled, default server address has to be your web server and the gateway of the web server has to be the IP of router.*
- PPP connection fails.
  - *Check signal power. If signal power is weak, you will have to use a better antenna. If the environmental cells have a similar signal it will be necessary to use a directive antenna. Signal levels have to be in the range -50 dBm and -90 dBm.*
  - *It is necessary to set ping, which will check the connection and, in the case of fail ping, restart connection.*
- PPP connection won't be established.
  - *Recheck GPRS settings - APN, name, password and IP address.*
  - *Try to enter PIN – verification if the SIM card hasn't set PIN code.*
  - *In private APN it is appropriate to switch the DNS server send off.*
  - *Switch log system on and observe where the error turns up.*
- Connection fails on Ethernet or connection isn't establishing.
  - *On ethernet interface of the router it is possible to switch auto negotiation off and set a rate and duplex by hand.*
- DynDNS not function.
  - *In private APN not functional.*
  - *If the same IP address is recorded in your canonic name as dynamically assign address, it means that the operator is using NAT or firewall.*
  - *NAT is possible to verify by the help of the ping on address of your server with static IP address and by the help of the router address verify and address in ping.*
  - *Firewall is possible to verify, for example by remote access on web interface.*

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- *The operator doesn't give out address DNS servers and without DNS server's it is impossible to connect to server dyndns.org. In log system will be this message:*
  - *DynDNS daemon started*
  - *Error resolving hostname: no such file or directory*
  - *Connect to DynDNS server failed*

✍ IPSec tunnel is establishing but communication doesn't function.

- *Probably it is badly set up route conditionals of connected equipment or it is bad set up GW.*

✍ FTP doesn't function.

- *Router doesn't support the active FTP mode, supports the passive mode only.*

✍ L2TP or IPSec isn't establishing.

- *Verify the reason in the log system.*

✍ I switched the router to offline mode by the SMS message, but the router is in online mode after restart.

- *Control SMS messages don't change the router configuration. For example, if the router is switched to offline mode by SMS message the router will be in this mode up to next restart. This behaviour is the same for next all control SMS messages.*

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11. Customers support

You can find current information about this product on our website:

www.conel.com

Upkeep-advices:

- The SIM-card must be handled carefully as with a credit card. Don't bend, don't scratch on this and do not expose to static electricity.
- During cleaning of the router do not use aggressive chemicals, solvents and abrasive cleaners!

Conel Company hereby declares that the router narrated in this user's guide fits all basic demands of directive 1999/5/EC (R&TTE).

Router fits values of coefficient SAR defined by association ICNIRP and values of "About protection of health before non-ionized radiation".

CE Declaration of conformity was issued and it is possible to find it on the Conel website (http://www.conel.com/download) [1] or at producer.

[1] Please, use the following login information: Username – ConelFreeDownload, Password – coneldownload.

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